U.S. DEPARTMENT OF COMMERCE AND THE FLAMMABILITY OF CLOTHING FABRIC*

A. F. ROBERTSON

Chief, Fire Research Section
National Bureau of Standards
Washington, D. C.

THE U.S. Department of Commerce is concerned about the tremendous suffering and waste resulting from accidental or "unwanted" fires. A monetary waste of roughly 1 per cent of the gross national product is not something to be complacent about. An assessment in dollar terms of the personal tragedy of the estimated 12,000 fire fatalities and 250,000 serious injuries from burns that occur each year would be very difficult to determine. The staggering loss is surely a burden for the public to carry. It seems appropriate, therefore, that attention should be directed to the causes of these injuries and fatalities. In this paper let us limit our interest to casualties associated with fires involving clothing.

SIZE OF THE PROBLEM

Although the National Fire Protection Association, the National Safety Council, and the Public Health Service publish information that may be used to estimate the over-all size of the problem, information on the circumstances leading to the accidents and the character of combustible material involved is, unfortunately, not available. However, experience in England, as well as fragmentary studies made in this country, suggest that these casualties involve clothing typical of that used by the population at large, and would be little influenced by other than major changes in the flammable character of materials considered acceptable for use in clothing. Again, by analogy with experience in

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England and Canada, we estimate that about one fifth of the fire fatalities, or about 2400 deaths, result from ignition of clothing each year. It seems likely that a much larger fraction, perhaps four fifths, or about 200,000, of the nonfatal fire injuries each year result from ignition of clothing. These are only approximations of course, but they provide a fair estimate of the size of the problem.

Inadequate Experience Records

To the best of our knowledge, although the complete loss records are not available, these losses have shown only a modest increase over the years, reflecting mainly the increase in the total population. In the late 1940's and early 1950's, the appearance on the market of highly flammable sweaters and play cowboy suits caused such highly publicized accidents that Congress became alarmed and passed the Flammable Fabrics Act* in 1953. By this act, the Commercial Standards CS-191-53** and CS-192-53,† as promulgated by the secretary of the U. S. Department of Commerce, were designated as the official means for determining the flammability of materials used for clothing. By Section 4*b* of the act, the secretary of the department is charged with the responsibility of recommending changes in the act if at any time he finds that the tests specified by the Commercial Standards are inadequate for protection of the public. The responsibility has been delegated, in turn, by the U.S. Department of Commerce to the National Bureau of Standards.

The act was intended to prevent the commercial distribution of unusually flammable fabrics or films used for clothing purposes. We believe this objective has been achieved, but we have neither a record of the casualties resulting from the lack of control prior to the act, nor adequate fire casualty records to show present experience. We do know, however, that it is difficult in the retail trade to secure clothing material that fails to pass the standards established by the act. We also know, subjectively, that although many clothing fire accidents occur, there are few accounts that describe accidents similar to those previously experienced with the torch sweaters and cowboy chaps.

The experience reported in Britain, as mentioned earlier, suggests that people are being burned in the clothing they commonly wear.

*Public Law 88, 83d Congress, First Session; 15 U.S.C.A., par. 1191; 67 Stat. 111: June 30, 1953.
**Flammability of Clothing Textiles CS191-53, U. S. Department of Commerce, June 30, 1953.
†General Purpose Vinyl Plastic Film CS192-53, U. S. Department of Commerce, May 22, 1953.

Because of this, we have been reluctant to recommend changes in requirements on flammability that would modify significantly the types of clothing material available to the public, particularly since such changes might not reduce significantly the number or the severity of accidents from burning. Thus, at present, we have no basis for predicting a reduction in accidents from burning reported if, for instance, a decision were arbitrarily made to characterize as hazardous fabrics that burn in less than 20 seconds rather than the 3.5 seconds specified in the present federal law.

The annual national expenditure for clothing represents about 30.5 billion dollars, or about 7 per cent of the total for all personal expenditure. This large expenditure surely justifies a careful study of our casualties resulting from ignited clothing. Such a study should provide data on accidents from burns with adequate background data, not only on the nature and causes of them but also, to the extent possible, on the type of clothing involved and technical properties of the fabric, including its flammability. It also would seem appropriate to consider the social and economic costs imposed on the public by a severe change of flammability requirements. For the present, we hope industry will continue research on and the development of clothing made of flame-retardant materials that will be economically, esthetically, and usefully acceptable to the public.

Work in Progress

Information on fire casualty experience is currently being secured with the cooperation of the U.S. Public Health Service, whose regional survey teams now operating in Denver and Boston are furnishing reports of great value. Our role in this work is to secure technical characterization of the clothing samples when these are available.

It will be some time, however, before anything like a national picture of the situation can be developed. The biases that can be introduced by localized reporting are evident from the limited study already made of the results obtained from Denver where, apparently, local collection of trash is not widely practiced. These results suggest that about 60 per cent of clothing-fire accidents result in one way or another from careless use of flammable liquids, usually gasoline which, in many cases, was being used for starting trash fires. Certainly, drastic changes in flammability of clothing fabrics would be necessary to

influence significantly the record of injuries from burns under such circumstances.

Several groups have encouraged adoption of NFPA Standard 702* instead of CS-191-53. This standard makes use of the same test equipment as CS-191-53, but the test method differs primarily by application of the flame continuously to the edge of the specimen rather than for one second to the surface of the specimen. The National Bureau of Standards has explored the possible use of this procedure and the effect it might have on the type of fabrics now considered acceptable. The results were surprising in showing that perhaps as few as 1 in 50 fabrics might be classified differently, but the burden of testing would be seriously increased since by the NFPA method all fabrics would be forced to ignite. One advantage that might be achieved by use of the NFPA Standard is derived from the inclusion of a qualitative test method for materials other than textile. It is evident, however, that NFPA Standard 702 does not provide a useful basis for selection of fabrics of significantly less hazardous flammability. Indeed, we must await results of the survey of accidents from burns that is now in progress to determine whether any but a drastic change in the method of testing would be useful as a basis for achieving significant reduction in accidents from burns.

The National Bureau of Standards also has made recent studies of the test equipment and procedures called for by Commercial Standard CS-191-53. The standing committee has been reconstituted to consider recommendations that the Federal Trade Commission, the National Bureau of Standards, and the public have made for revision of this standard. The changes being considered, if adopted as the legal basis for rejecting unusually flammable fabrics, will be of a type that will define the test method more adequately and, thus, permit closer duplication of results between laboratories but will not necessarily provide any significant change in the potential hazard presented by clothing.

The National Bureau of Standards is also exploring new and improved methods for measuring the transfer of heat between fabric and skin. We plan to continue these studies as part of our work to achieve a better understanding of the hazards involved and thereby assist in reducing the tragedy of casualties from burns.

*Fire Tests: Flame-Resistant Textiles and Films, 1966, NFPA 702, National Fire Protection Association, Boston, Mass.

Summary

The U. S. Department of Commerce is concerned with the great national waste and suffering caused by unwanted fires. It is sensitive to the need for public safety, as evidenced by the Flammable Fabrics Act.

The National Bureau of Standards, under its delegated authority, has conducted studies of existing and modified test methods for measurement of flammable hazards associated with clothing fabrics. A cooperative program has been initiated recently with the Public Health Service to secure records of injuries from burns; these records should yield evidence on the type of fabrics currently associated with injuries from ignited clothing. This program is just starting, and we expect that it will be some years before a clear understanding of the national picture becomes available. However, when the results of this survey become available, we expect to have a better technical understanding of the causes of clothing-fire accidents and of ways of reducing them. To date there appears to be no technical evidence to show that a significant reduction in the number of accidents from burning clothing can be achieved without major changes in the flammable behavior of clothing fabrics. Thus, we hope that industry will continue the development of permanently retardant-treated fabrics that will be economically, esthetically, and usefully acceptable to the public. We believe, although we have no direct evidence, that such fabrics will significantly reduce, but not eliminate, clothing-fire injuries.